W-058E
c2

THE FARE BASIS SURVEY AND DISCOUNT AIR FARE UTILIZATION IN THE DOMESTIC MARKET

John A. Greig and Emile Di Sanza

Paper Presented at the 20th Annual Meeting
of the Canadian Transportation Research Forum
May 28-31, 1985 - Toronto, Ontario

THE FARE BASIS SURVEY AND DISCOUNT AIR FARE UTILIZATION IN THE DOMESTIC MARKET

John A. Greig and Emile Di Sanza*

The late seventies witnessed a fundamental change in the pricing strategies of the domestic air carriers. Challenged by the development of the seat management concept[1], the authorization of charter competition on domestic routes and the impact of airline deregulation in the United States, the Canadian airlines responded with a proliferation of new fares reflecting a greater degree of market segmentation.

During this period, the Research Branch of the Canadian Transport Commission reported[2] on the changing mix of full fare and discount fare products available in the domestic market using air fare data received from the air carriers as special filings to the Commission. In

---

*John Greig is the A/Director of Passenger Transport Studies, Research Branch, Canadian Transport Commission. Emile Di Sanza is the project leader for the Fare Basis Survey, Aviation Statistics Centre, Statistics Canada. The views and opinions expressed in this paper are those of the authors and do not necessarily reflect those of the Canadian Transport Commission or Statistics Canada.

response to the identified limitations in the special filings approach, particularly those related to the lack of uniformity in concepts and the discontinuous time series which was developing, the "Fare Basis Survey" was established in order to meet ongoing fare monitoring requirements. The survey was developed by the interdepartmental Aviation Statistics Requirement Committee[3] in consultation with the airline industry and reporting began in January 1983.

Purpose

This paper has two objectives: first, to introduce the "Fare Basis Survey" which has replaced the special filings and ad hoc surveys of the period 1978-1982; and second, to report on one application of the survey related to discount fare utilization in Canada.

The first section of this paper includes a discussion of the concepts underlying the survey, the survey design, the type of data reported, and the question of data reliability.

The second section reports on the proportion of Canadian air travellers using discount fares, the variability amongst different markets, and the

comparability between the Canadian experience with discount fares and that in the United States.

PART I

THE "FARE BASIS SURVEY" AN INTRODUCTION TO THE STATISTICAL FRAMEWORK

The "Fare Basis Survey" provides estimates of fare type utilization (and a respective measure of each estimate's reliability) in terms of traffic volume, fare revenue, and such derived indices as yield for the scheduled services of Canadian Level I carriers[4]. The carriers participating in the survey are: Air Canada, CP Air, Pacific Western Airlines (PWA), Nordair, Eastern Provincial Airways (EPA), Quebecair[5] and, effective with the initiation of its international scheduled service, Wardair.

Sample Design

The survey is designed to be conducted recurrently in accordance with a stratified random sample of 56 days per calendar year. The sample is based on a stratification by quarter and by day of the week which provides 28 strata; two days are chosen per stratum via a modified systematic selection.

Stratification by quarter facilitates the production of estimates at a quarterly level, an important requirement given pronounced seasonal variations in air travel. Stratification by day of the week is consistent with heterogeneity among days of the week in regards to traffic volume and fare composition.

The selection of a new set of sample days for each year is based on the following method[6]. One ordered pair of initial days (n_1, n_2) is selected as the random start from 65 possible combinations in the set:

$\{(n_1, n_2) | n_1, n_2 \varepsilon (1, 2, \ldots, 13), n_1 < n_2, n_2 - n_1 \neq 6, 7\}$

Every 13th day from these initial sample days is then selected, resulting in a quarterly sample of 14 days divided between two replicates as illustrated in Chart 1.

CHART 1: SAMPLE SELECTION

Random Start $(n_1, n_2) = (3, 8)$

			n_1					n_2					
APRIL	1	2	3	4	5	6	7	8	9	10	11	12	13
	14	15	16	17	18	19	20	21	22	23	24	25	26
APRIL/MAY	27	28	29	30	1	2	3	4	5	6	7	8	9
	10	11	12	13	14	15	16	17	18	19	20	21	22
MAY/JUNE	23	24	25	26	27	28	29	30	31	1	2	3	4
	5	6	7	8	9	10	11	12	13	14	15	16	17
	18	19	20	21	22	23	24	25	26	27	28	29	30

This sample design ensures dispersion of the sample days throughout the quarter in order to capture, as much as possible, changes in fare type utilization.

Survey Concepts and Methods

The universe consists of all "lifted" flight coupons (i.e., those used for travel) in a carrier's system applicable to scheduled services; reportable coupons are those which are lifted on one of the designated sample days.

Data selected from the reportable coupons are as follows:

1) Fare basis code
2) Coupon Origin & Destination (O&D)
3) Number of passengers
4) Revenue

The fare basis code is an alphanumeric code denoting the applicable service, discount and restrictions on travel. For the participating carriers, there are approximately 1,800 such codes or tariffs in effect. Since some of these codes are essentially identical, certain carriers regroup them into fare type codes resulting in approximately 700 carrier-specific fare codes being reported in the survey.

The coupon O&D identifies the two locations between which the coupon was used for passage. Data are reported for approximately 600 domestic and international coupon O&D city-pairs. The incidence of fare codes by city-pair will vary according to size and type of market, number of competing carriers and season. Some of the larger city-pairs have upwards of 100 fare codes reported in a quarter.

The revenue reported is the allocated portion of the revenue from the ticket associated with a particular coupon. Where the coupon comes from a one coupon ticket, all the ticket revenue is allocated to that coupon; where the coupon comes from a multi-coupon ticket, the ticket revenue is prorated. Although procedures for revenue proration vary considerably (contingent upon the nature of the itinerary, the type of fare, etc.), the basic method used is the "Straight Rate Proration Principle" whereby ticket revenue is prorated in proportion to the applicable prorate factors (usually the local regular economy fares) associated with the city-pairs of the coupons comprising the ticket.

Carriers report passenger volume and revenue aggregated by fare code and coupon O&D for each sample

day; approximately 70 000 such records are reported per quarter.

Population estimates are produced by applying the respective sampling weight of each stratum to the passenger volume and revenue values for each record in that stratum. The sampling weight is based on the number of occurrences of each day of the week in a particular quarter divided by the number of sample days selected for each stratum; thus the sampling weight will be either 6, 6.5 or 7.

Direct estimates (passenger volume, revenue) and derived indices (revenue passenger kilometres, yield) are produced for specified domains. A domain is defined in terms of carrier choice, fare designation, reference period and geographical entity. The criteria and parameters for defining the domain according to these components are summarized below.

Fare can be defined as (i) the reported fare code, either a discrete fare basis code (e.g., YHXE27) or the equivalent carrier code, (ii) an aggregate fare type (e.g., Advance Purchase Excursion) or (iii) a generalized fare group or category (e.g., Discount fare). Fare can be further differentiated according to the level of discount relative to the regular economy fare.

Because of sample design, the shortest reference period for which estimates may be produced is the quarter; from these basic estimates, year-to-date and annual estimates may be derived.

Geographical entity is based on the reported coupon O&D. It can be specified as a directional/combined ccupon, market, hub, zone, sub-sector, sector or system. Analytical criteria, such as city-pair distance and passenger density can be applied to further refine the definition of the domain.

In evaluating the results of the "Fare Basis Survey" it is important to consider that it is based on flight coupon data. This compares, for example, to the "Passenger Origin and Destination Survey" which is based on ticket origin and destination and the "Airport Activity Survey" based on flight segment data[7]. A coupon-based reporting format allows a linkage between market based data and airport activity data; its limitation, however, is that in itself, it does not allow for differentiation of local and through traffic.

Data Quality and Reliability

The collection of fare basis data within the framework of a survey dedicated specifically to fares

tends to minimize data deficiencies resulting from non-sampling error. In addition, because the flight coupon is a basic source for the carriers' own revenue accounting systems, data capture of coupon data by the carriers is a centralized computer-assisted operation and subject to internal verification resulting in relatively accurate and timely reporting at marginal cost and response burden to the carrier.

Reported data are computer-edited by the Aviation Statistics Centre to ensure proper sample selection, valid entries and logical inter-field dependencies. Using the respective regular economy fare of a coupon city-pair as a benchmark, intra- and inter-carrier analyses are performed to detect inconsistencies between fare code and average fare values.

Sampling error for estimates of totals (passenger volume, revenue, etc.) is derived from the standard formula used in a stratified replicated sample design while the Balanced Repeated Replication technique is used for estimates of ratios and proportions[8].

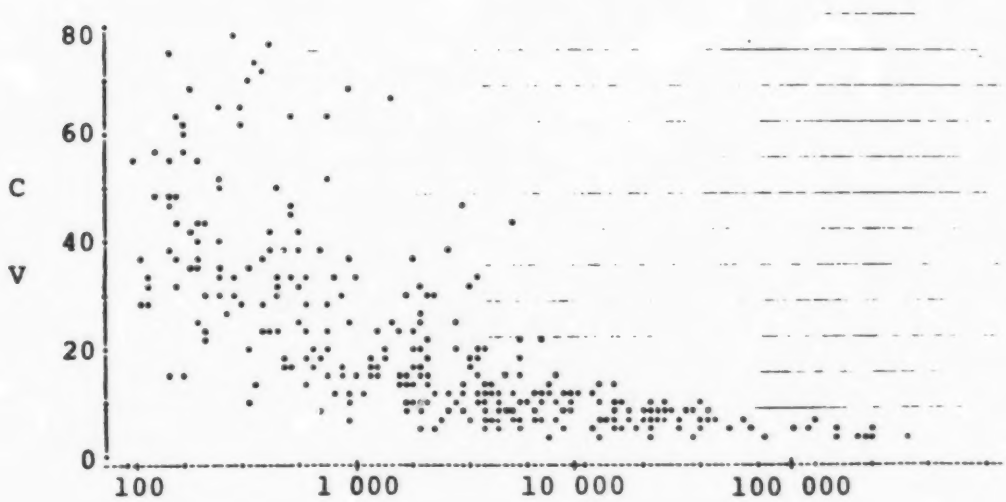
A measure of the estimate's reliability is provided by its associated coefficient of variation (c.v.), defined as the ratio of the estimate's standard

error to the estimate itself, expressed as a percentage. Estimates with a coefficient of less than 10 can be generally considered to be reliable from a sampling point of view.

As an indication of the reliability of the estimates for a characteristic of primary interest (i.e., discount passengers), the c.v. of the passenger volume estimate was plotted against the quarterly coupon city-pair passenger volume; the results are illustrated in Chart 2 below.

Chart 2

SCATTERPLOT: COEFFICIENT OF VARIATION OF DISCOUNT PASSENGER VOLUME AGAINST COUPON O&D ESTIMATE OF TOTAL PASSENGER VOLUME - THIRD QUARTER 1983



Passenger Volume Estimate (logarithmic scale).

Very poor reliability is apparent for markets below 1 000 passengers; however, as the market size approaches 10 000 passengers the reliability of discount passenger estimates increases markedly. Above 10 000 virtually all estimates fall within the normally acceptable range.

Finally, where appropriate, supplementary measures of reliability may also be derived. The reliability of passenger volume estimates may, for example, be established by means of confidence intervals. In evaluating estimates (e.g., discount passengers as a proportion of total passengers) over a period of time, the significance of the difference between the estimates may be determined by testing for the null hypothesis for a predetermined level of significance of the test statistic.

PART II

SOME PRELIMINARY RESULTS FROM THE FARE BASIS SURVEY

The first section of this paper has outlined the statistical framework within which fare data are collected in Canada. By virtue of its conceptual basis and relatively broad coverage, the survey accommodates considerable analytical scope. This section reports on one application of the "Fare Basis Survey", in particular, that related to the utilization of discount fares within the domestic market.

The Utilization of Discount Fares, 1978-1983

Until 1977 the range of air fares available in the domestic marketplace was rather limited. There were scheduled First Class fares, Economy Class fares and a small number of excursion fares available only during off-peak periods. Since 1977 there has been a proliferation of more generally available discounted air fares to complement the provision of the regular First Class and Economy Class fares.

This trend towards a more complex tariff structure in Canada, and indeed towards the increased marketing of discount air fares can be traced to three

events during the late seventies: (i) the development of the surplus seat concept which, in 1977, led to the first offering of a discount excursion fare program on domestic secheduled services during the summer peak travel period; (ii) the authorization of domestic Advance Booking Charters in 1977 to compete with the scheduled services in developing the market for lower priced travel in Canada; and (iii) the Airline Deregulation Act of 1978 which brought rapid changes to the U.S. domestic market in terms of price levels and the range of fare types offered. The proximity of U.S. airports to Canada's largest population centres has meant that the Canadian industry could not be far behind that in the United States without risking traffic diversion to U.S. carriers.

Understanding the impact of these events on both the travelling public and the domestic air carrier industry has required the extensive review of many inter-related issues; among them, how many travellers are flying on discount fares, at what price levels and under what conditions of sale. It is the measurement of the number of travellers using discount fares which is the focus of this section of the paper.

Data sources available in the period 1978 through 1982 had the effect of subdividing this issue into two components: that related to the utilization of deep discount fares[9] on Air Canada and CP Air and that related to the volume of passenger carriage on domestic charter air services.

Table 1 indicates that in this period (1978-1982) there was a major increase in the carriage of passengers on deep discount fares. In 1978, 14.5% of Air Canada and CP Air's output, as measured by revenue passenger kilometres, was accounted for by the carriage of passengers on such fares. This increased to 37% in 1982. In addition, by 1982, for every ten revenue passenger kilometres produced in discounted scheduled services, one was produced in domestic advance booking charter services[10].

Table 1 also endeavours to provide a link between the old (1978-1982) and the new (1983) data series. Thus the carriage of deep discount traffic as a proportion of total carriage on Air Canada, CP Air, EPA, Nordair and PWA in the southern domestic sector[11] amounted to 48% in 1983. This compares with 56% representing the proportion of total carriage accounted for by all discount fares on the same carriers in 1983 (see

Table 1

DISCOUNT TRAFFIC AS A PERCENTAGE OF TOTAL DISCOUNT AND FULL FARE TRAFFIC SOUTHERN DOMESTIC SECTOR

(Measured in Revenue Passenger Kilometres)

	Deep Discount Traffic	All Discounts
1978	14.5	N.A.
1980	25.3	N.A.
1982	37.3	N.A.
1983	48.1	55.5

Notes:

1. Deep discount ~~traffic~~ fare is that discounted by 25% or more off the full economy fare.
2. Revenue passenger kilometre data for 1978, 1980 and 1982 are tabulated from flight segment data of Air Canada and CP Air. Not included in these data is deep discount traffic carried on CP Air's western route, nor domestic portions of international flights.
3. Revenue passenger kilometre data for 1983 are tabulated from flight coupon data of Air Canada, CP Air, EPA, Nordair and PWA. Southern domestic services including domestic portions of international flights are included in these data.

Sources:

1978, 1980, 1982 Special Filings to the Air Transport Committee.
1983, Air Carrier Fare Basis Statistics reported to the Air Transport Committee, Scheduled Services, Preliminary Estimates.

Table 1) and 61% representing again the same proportion but for domestic scheduled and charter services (see Table 4).

A More Detailed Review of the Utilization of Discount Fares in 1983

A more detailed review of the mix of full and discount fares available in 1983 is important from a number of perspectives. First, 1983 is the year preceding the increased liberalization of domestic pricing as envisaged in the New Canadian (1984) Air Policy. As such the 1983 results become a benchmark against which to measure change as the air transport industry moves into a less regulated environment.

As well, 1983 is the first year for which data are available from the "Fare Basis Survey". In itself this has facilitated the implementation of two changes relative to the monitoring of domestic pricing. The monitoring now encompasses the domestic scheduled services of Level I carriers, not just those of Air Canada and CP Air. In addition, the interest is no longer focused exclusively on deep discount fares, (where the major product initiatives took place in the years 1978 through 1982), but rather the emphasis is on

discount fares in general, recognizing that the New Canadian (1984) Air Policy calls for the deregulation of pricing on discount fares by May 1986.

Table 2 reports on the distribution of passengers and revenue passenger kilometres by fare type within the southern and northern domestic sectors in 1983.

The fare basis codes reported by the participating carriers have been classified by general fare groups. The fare groups presented in the tables are as follows:

1) Premium Fare comprising First Class;
2) Full Fare comprising full fare Regular Economy;
3) Discount Fare comprising the various discount fares such as Charter Class, Seat Sales, Advance Purchase Excursion, Group, Senior Citizen, Youth, Family Plan Dependents, etc; and
4) Other comprising Industry and Agency Discount fares and Military as well as unknown fare codes.

The table indicates that in terms of passengers carried on domestic scheduled services 46% travelled on some form of discount ticket in 1983. In fact the actual number is likely somewhat higher insofar as some proportion of tickets with 'unknown' fare codes will be discount tickets. In terms of the carriage of discount traffic there is an identifiable third quarter peak.

Table 2

DISTRIBUTION OF PASSENGERS AND REVENUE PASSENGER KILOMETRES BY FARE TYPE WITHIN THE SOUTHERN AND NORTHERN DOMESTIC SECTORS, PRELIMINARY ESTIMATES, 1983

% Distribution by Fare Type

	Premium Fare	Full Fare	Discount Fare	Other and Unknown
SOUTHERN SECTOR				
Passengers				
1st Quarter	0.7	55.6	37.3	6.3*
2nd Quarter	0.8	49.1	45.3	4.9
3rd Quarter	0.7	42.0	50.7	6.6
4th Quarter	0.8	47.4	48.8	3.1
Annual	0.8	48.1	45.9	5.2
Revenue Passenger Kilometres				
Annual	1.4	37.3	55.5	5.8
NORTHERN SECTOR				
Revenue Passenger Kilometres				
Annual	--	65.1	33.6	1.4

Note: The asterisk indicates a coefficient of variation between 10 and 25%.

Source: Air Carrier Fare Basis Statistics reported to the Air Transport Committee, Scheduled Services, Level I Carriers, based on Flight Coupon Origin and Destination.

When the distribution is expressed in terms of revenue passenger kilometres, the annual proportion of output corresponding to travel by discount passengers increases to 56%. The relationship between the passenger and the revenue passenger kilometre proportions indicates a greater carriage of discount passengers on the longer haul services, a supposition corroborated by Table 3.

Finally, the table indicates that in northern services, a smaller proportion of output is accounted for by the carriage of discount passengers.

Table 3 reports the percentage carriage of discount fares by volume and distance categories. The table shows an increased proportion of discount traffic carried as the length of haul increases. No such simple pattern is evident in regards to the volume categories although there are differences amongst the cells suggesting market specific influences. The range of variation in the volume categories is considerably less than that in the distance categories.

Table 4 provides a comparison of Canadian and U.S. statistics relative to the carriage of discount traffic. The U.S. data are that reported by the Air

Table 3

PERCENTAGE CARRIAGE OF DISCOUNT FARES BY VOLUME AND LENGTH OF HAUL WITHIN THE SOUTHERN DOMESTIC SECTOR PRELIMINARY ESTIMATES, 1983

Volume (Psgrs/Day*)	LENGTH OF HAUL (KILOMETRES)			
	0-600	601-1200	1201-2400	2401+
10 - 50	39.5	42.1	56.9	66.0
51 - 200	34.9	50.8	52.6	54.1
201 - 500	34.5	41.1	58.1	60.4
501 +	28.7	54.3	57.2	64.6

Note:

*As defined by 1983 passenger traffic reported in the "Fare Basis Survey".

Source:

Air Carrier Fare Basis Statistics reported to the Air Transport Committee, Scheduled Services, Level I Carriers, based on Flight Coupon Origin and Destination.

Table 4

DISCOUNT TRAFFIC
A CANADA - U.S.A. COMPARISON
1983

	Canada	U.S.A.
Discount Traffic as a Percentage of Total Revenue Passenger Kilometres (RPK's)	61%	82%
Discount Yield as a Percentage of Full and Premium Fare Yield	47%	52%

Notes:

1. Carrier coverage:

   Canada - Level I Air Carriers, scheduled and charter for the computation of discount traffic, scheduled only for the computation of discount yield, domestic southern operations.

   U.S.A. - Majors, domestic and transborder operations.

2. Discount traffic:

   Canada - does not include first class discounts.

   U.S.A. - includes first class discount.

3. Total Traffic (RPK's):

   Canada - discount, full and premium fares as measured by flight coupons.

   U.S.A. - as measured by flight segment data.

4. Yield Comparison: Fare type yield is the total revenue by fare type divided by the RPK output by fare type.

Source:

Canada - Air Carrier Reports to the Air Transport Committee. Canadian data are preliminary.
U.S.A. - Air Transport Association of America survey of major American airlines.

Transport Association of America on: (i) discount traffic as a proportion of total revenue passenger kilometres and (ii) discount yield as a proportion of full and premium fare yields. Comparable Canadian data have been generated using the information available from the "Fare Basis Survey" supplemented by charter data.

In Canada, in 1983, 61% of the revenue passenger kilometres were accounted for by persons travelling on discount fares on the scheduled and charter services offered by Level I carriers. This compares to 82% in the United States on major carriers. The discount yield on scheduled services, in Canada, was 47% of the full and premium fare yield compared to 52% in the United States.

It is cautioned that as a measure of average discount the above proportion is an overestimate as it is influenced by the relative mixes of traffic at the different lengths of haul.

Conclusion

The issue of air fare type utilization in the domestic market is expected to assume even greater relevance in the years ahead as the Canadian air carriers respond to the increased pricing freedoms afforded in the

New Canadian (1984) Air Policy and as the debate on the direction and extent of further deregulation continues.

This paper has introduced the "Fare Basis Survey" including a review of the concepts underlying the survey, the survey methodology and the reliability of the estimates. In addition, the paper has reported on one application of the survey, in particular, the mix of full and discount fares available in the domestic market. It is hoped that this two-pronged approach, that is, a review of methodology and a preliminary interpretation of some pertinent results, will prove to be of assistance to industry observers as they endeavour to assess the progress of the domestic airline industry as it moves into a period of less regulation.

FOOTNOTES:

1. Application of the concept enables a carrier to define, based on historical traffic patterns, capacity (seats) supplemental to that required to meet the needs of the full fare traveller.

2. Canadian Transport Commission, A Review of Domestic Low-Priced Air fares: January-August 1978, Ottawa, December 1978.

   Canadian Transport Commission, A Review of Low-Priced Air Fares: 1979, Ottawa, November 1980.

   Canadian Transport Commission, The Low-Priced Air Fare Review: A Three-Year Perspective, Ottawa, March 1982.

Canadian Transport Commission, The Low-Priced Air Fare Review: The First Five Years, Ottawa, November 1983.

3. This Committee has respresentation from Statistics Canada, the Canadian Transport Commission and Transport Canada.

4. As established by criteria specified in the Air Carrier Regulations Part VIII, Section 146(1)a (revised 1981).

5. Quebecair began reporting in January 1984 on a limited basis.

6. The method described applies to quarters which have 91 days; the procedure is modified slightly to adjust for quarters which have 90 or 92 days and to avoid clustering the sample.

7. Concepts and methods relating to these surveys are described in the following Statistics Canada publications: Air Passenger Origin and Destination - Domestic Report (Catalogue 51-204), Air Carrier Traffic at Canadian Airports (Catalogue 51-005).

8. A technical description of the methodology for variance estimation, as developed by R. Carpenter of the Business Methods Survey Division (Statistics Canada), is available from the Aviation Statistics Centre.

9. Deep discount fares are those discounted by 25% or more off the full economy fares.

10. Canadian Transport Commission, The Low-Priced Air Fare Review: The First Five Years, Ottawa, November 1983, page 43.

11. The dividing line separating the southern and northern domestic sectors is defined by: the 50th parallel from the Atlantic Ocean to the Ontario-Manitoba boundary, the diagonal joining the 50th parallel at the Ontario-Manitoba boundary to the 55th parallel at the Manitoba-Saskatchewan boundary and the 55th parallel from the Manitoba-Saskatchewan boundary.